Precision public health: mapping child mortality in Africa

Article (Published Version)

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Published Online
September 25, 2017
http://dx.doi.org/10.1016/S0140-6736(17)32280-8

See Online/Articles
http://dx.doi.org/10.1016/S0140-6736(17)31758-0

Spurred by Millennium Development Goal (MDG) 4, substantial progress in reducing child deaths was made between 1990 and 2015 around the world. The global under-5 mortality rate decreased from 90·6 deaths per 1000 livebirths in 1990 to 42·5 in 2015, a reduction of 53%.[1] This equated to a worldwide reduction in annual number of under-5 deaths from 12·7 million to 5·9 million.[1] Although this is an enormous accomplishment, and has been celebrated, these and other analyses have made clear that achievements varied considerably by cause of death,[2] region,[3,4] and country.[5,6] As the global community directs its energies towards the Sustainable Development Goals (SDGs),[7] it is essential to examine these and even more granular variations to target interventions and resources for optimal impact.

Several recent analyses will be foundational in global efforts towards the SDG target for child mortality of no more than 25 under-5 deaths and 12 neonatal deaths per 1000 livebirths in every country of the world by 2030.[7] For example, Burke and colleagues[5] used Demographic and Health Survey data across sub-Saharan Africa to show the importance of subnational factors in variations in child mortality in the 1980s, 1990s, and 2000s. Liu and colleagues[2] modelled vital registration and verbal autopsy data to identify leading causes of under-5 death in countries with very high mortality rates. Is there more to be added to these child mortality explorations?

Now, in *The Lancet*, Nick Golding, Roy Burstein, and colleagues[8] provide estimates of under-5 and neonatal mortality rates that aim to enable "precision public health"[9] across Africa. Their analyses benefit from a large range of sources (235 surveys), more robust modelling, more contemporary estimates (to 2015), high spatial resolution of estimates (5×5 km), and more rigorous tests of the predictive ability of the model than previously used. Novel developments in this analysis include the use of summary birth histories in addition to complete birth histories.[10] The authors applied age-specific and period-specific adjustments, generated from surveys in which both complete and summary birth histories were available, to surveys in which only summary birth histories were available, thereby greatly increasing the number of usable datasets. Another novel approach is the use of ensemble methods, which were originally developed to improve predictive power in infectious disease mapping,[11] to increase rigour in selection of covariates and identification of interaction. Four sub-models were fitted (generalised additive models, boosted regression trees, lasso regression, and ridge regression) for each age group and timepoint, and a Bayesian geostatistical model was then fitted using the cross-validated predictions. Given the distinction of under-5 from neonatal targets in SDG 3.2, the authors distinguished four age groups during modelling and report neonatal and under-5 results separately. Model validation was extensive and indicated generally good model fits.

The overall declines in child mortality previously documented[1] are substantiated and displayed by Golding, Burstein, and colleagues using intuitive figures that include representation of uncertainty intervals. Crucially, rates are presented at four levels of resolution: national, administrative 1, administrative 2, and 5×5 km. This level of detail allows striking subnational variations to be highlighted in under-5 and neonatal mortality rates, and in rates of decline from 2000 to 2015. For example, in 2015, even in countries that achieved MDG 4, two-fold variations in under-5 mortality rates can be seen across administrative 2 levels (eg, per 1000 livebirths, the lowest estimate by district in Liberia was 54·2 *vs* the highest estimate of 120; the lowest estimate by wilaya in Tanzania was 34·7 *vs* the highest estimate of 89·3). This level of precision is important for equitable policy making and efficient targeting of resources, and sets a high standard for future analyses of child mortality.

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Some limitations remain, although most are acknowledged by the authors. Scarcity of summary birth history data from some regions poses continuing challenges and increases uncertainty: stronger vital registration systems must remain the ultimate goal. Migration was not accounted for, and potentially important covariates such as access to water and sanitation and immunisations were not included in the analyses. Future work will need to address these gaps. For even greater precision in directing resources for child health, we urge scaling up the approach globally and disaggregating data to the third administrative level, the level at which resourcing decisions are made in many countries.

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We declare no competing interests. KD is supported by a Wellcome Trust Intermediate Fellowship in Public Health and Tropical Medicine (grant number 201900).

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